

INSECTS OF MICRONESIA

Hemiptera: Saldidae*

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INTRODUCTION

Shore-bugs are semiaquatic insects and constitute an integral part of the biotic communities of littoral faunas of fresh, alkaline, and salt waters. They inhabit all continents and almost all continental and oceanic islands. Systematically, they are classified in the families Saldidae and Leptopodidae.

The present paper deals mostly with shore-bugs collected during the recent insect survey of Micronesia and other material from there in Bernice P. Bishop Museum and in the Drake Collection, United States National Museum. A few specimens were kindly sent to us by the late Dr. Teiso Esaki, Kyushu University, Fukuoka, Japan. Most collectors, except specialists in aquatic Hemiptera, devote very little time to netting shore-bugs in faunal surveys because of their distinctive habits, environmental requirements, and specific habitats. Consequently, these insects are usually poorly represented in such collections.

The United States Office of Naval Research, the Pacific Science Board (National Research Council), the National Science Foundation, and Bernice P. Bishop Museum have made this survey and publication of the results possible. Field research was aided by a contract between the Office of Naval Research, Department of the Navy, and the National Academy of Sciences, NR 160-175.

The following symbols indicate the museums in which specimens are stored: US (United States National Museum), CAS (California Academy of Sciences), BISHOP (Bernice P. Bishop Museum), and KU (Kyushu University).

I am very grateful to Dr. J. L. Gressitt, Bernice P. Bishop Museum, for the privilege of studying collections of Saldidae from Micronesia and other islands of the south Pacific and Indian Oceans. The drawings were made by Mr. Arthur Smith of the British Museum, Mrs. Richard Froeschner, Bozeman, Montana, and Mrs. Patricia Hogue, Arlington, Virginia.

In the structural measurements, 80 units are the equivalent of one millimeter.

* This represents, in part, Results of Professor T. Esaki's Micronesian Expeditions (1936-1940), No. 109.

ZOOGEOGRAPHY

The absence of specimens of Leptopodidae indicates that this family may not yet inhabit the Micronesian islands. Leptopodids are found in Taiwan, Hainan, the Philippine Islands, Ceylon, Sumatra, and Java. Several species of this family are widely distributed on the mainlands of India, Africa (including Madagascar), Australia, and the Mediterranean Region. *Patapius spinosus* (Rossi) of the Palaeomediterranean region was unintentionally imported several years ago into California, where it is now established over a considerable area along the Pacific coast. This is the only leptopodid found in the New World.

The saldid genera and their components inhabiting Micronesia and other islands of the south Pacific and Indian Oceans present interesting ecological relations and widely discontinuous patterns of distribution. Insofar as known, all species of the marine genera *Omania* Horváth and *Salduncula* Brown are primarily halophilous.

Members of the genus *Omania* are subjected to extreme phenomena in their habitats that are rarely encountered by shore-bugs elsewhere. Their biotopes on precipitous rocks, coral reefs, and other rocks within the tidal strata are wind-swept, wave-beaten, tide-flooded, and exposed to the force of gales of the seas. During low tide, adults and nymphs are active and move about on the exposed surface of moist intertidal rocks. With the incoming of flood tide, they retreat into the holes, hollows, cracks, and interspaces in the rocks for protection and remain there beneath the surface of the sea until the tide recedes.

The species of the moderately large genus *Pentacora* Reuter of the islands of the south Pacific and Indian Oceans, Malay, Australia, Mediterranean Region, and North and South America, with the exception of one species, are primarily halophitic. The global genus *Saldula* Van Duzee, which comprises more species than all other genera of shore-bugs taken together, includes: species that inhabit the shores of standing and running fresh waters; species that inhabit shores along the seacoasts and inland salt waters, including brackish estuaries and the mouths of streams emptying into the oceans; and species that thrive almost equally well in various abodes on the shores of fresh, alkaline, mineral, and salt waters. A considerable number of species of *Saldula* and several other genera are widely distributed and inhabit both Eastern and Western Hemispheres.

The widely discontinuous records of distribution of genera and species are charted in the table. It seems unwise to formulate definite conclusions as to origin, avenues of dispersion, and patterns of distribution from such meager

data. None of the saldid genera now described is endemic to Micronesia or even to other islands of the south Pacific and Indian Oceans. There are, however, a number of insular species apparently endemic to Micronesia and also to other island groups of Oceania, especially oceanic islands far removed from other groups and the mainland.

The Micronesian *Salduncula swezeyi* (Usinger) has recently been taken on intertidal rocks and coral reefs off the shores of Queensland, Australia. The genera *Salduncula* and *Omania* are known only from tropical or subtropical marine habitats of the Eastern Hemisphere. *Saldula* is not only the dominant genus in Micronesia and other islands of the seas, but likewise on all continents. This genus of about 120 species is represented by nearly an equal number of species in the Eastern and Western Hemispheres.

Five species of Saldidae are recorded here from Micronesia, including the three species described as new. Another new species is characterized from Fiji.

In addition to the Micronesian and Fijian species, the insular species *Saldula mametiana* Drake (fig. 8) from Mauritius, *Salduncula woodwardi* Drake (fig. 2) from Samoa, *Pentacora sororia* Drake (fig. 9) from Solomon Islands, *Omania marksae* Woodward (fig. 11) from coral reefs off the seacoast of Queensland, and *Saldoida armata* Horváth (figs. 12, 13) from the Philippine Islands, Taiwan, Hainan, and India are illustrated. The only described species of the little-known genus *Orthophrys* (*O. pygmaeum* Reuter) of the Mediterranean Region is illustrated (fig. 10). The illustrations are employed in the generic keys and descriptions for severizing the genera occurring in Micronesia and other islands of the south Pacific and Indian Oceans.

Pterygopolymorphism raises interesting queries relative to emigration, colonization, and existence of Saldidae on the rocky tide-flooded shores of oceanic islands. Brachypterous forms have shortened hemelytra and obsolete meta-thoracic wings and thus are completely flightless. The macropterous forms have two pairs of long, fully developed wings and are capable of sustained flight. Macropterous specimens of several species have been taken "at light" at night, mostly during the first few hours of darkness.

Collections of the genus *Saldula* from Micronesia and the Hawaiian Islands present almost diametric pictures in alary development. Of the 30 specimens of *Saldula* (four species) from Micronesia, all are macropterous with fully developed wings. In contrast, only one out of a series of 125 specimens (five species) from the Hawaiian Islands is macropterous, the other 124 having abbreviated hemelytra and atrophied hind wings. So far, the species of this genus examined from other islands in Oceania all have two pairs of long, fully developed wings. *Salduncula*, the other genus found in Micronesia, is known from there and elsewhere only in the macropterous state.

The whitish flavous cross-band of the hemelytra separates this small, oblong brownish-black shore-bug from its congeners. The female holotype is illustrated (fig. 1). *Salduncula woodwardi* Drake of Samoa is also illustrated (fig. 2). These two species are quite similar in form and size but can be readily separated from each other by the color markings on the hemelytra and the slight difference in the male parameres. In a specimen of *S. swezeyi* from Guam and another from Queensland, the hemelytral band is slightly interrupted

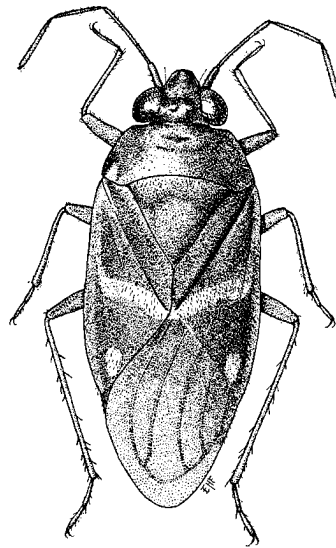


FIGURE 1.—*Salduncula swezeyi*.

on each hemelytron. The genotype, *S. seychellensis* Brown, is a broader species than either *swezeyi* or *woodwardi*, and the color markings on the hemelytra are different.

Genus *Saldula* Van Duzee

Saldula Van Duzee, 1914, Canadian Ent. 46 (11) : 387; 1914, San Diego Soc. Nat. Hist., Trans. 2 : 32.

Acanthia Reuter (not Fabricius, 1775), 1914, Öfv. Finska Vet.-Soc., Förh. 54 (A) : 8, 14.

Type species: *Cimex saltatorius* Linnaeus.

The characters employed in the generic key distinguish the members of this genus from those of other genera occurring in Micronesia and other regions

of Oceania. The median vein of the corium is forked apically, and the membrane of the hemelytron is composed of four long, closed cells in the macropteran form. In the brachypteran form, the membrane is much reduced and one or two cells are frequently absent. A closely related genus, *Micracanthia* Reuter, is not known to occur in Oceania or the Orient.

Saldula is worldwide in distribution and found in all faunal realms. Variations in size, color, and markings at times make a number of its members rather difficult to identify.

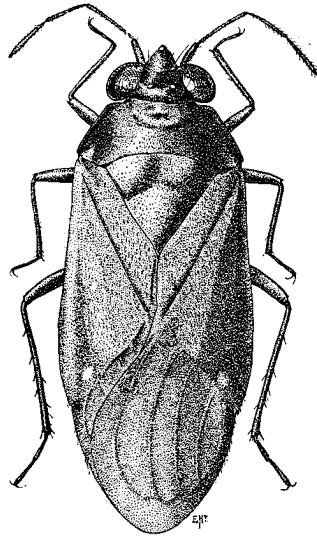


FIGURE 2.—*Salduncula woodwardi*.

KEY TO MICRONESIAN SPECIES OF SALDULA

1. Small, less than 2.60 mm. long, antennal segments II, III, and IV subequal in length to one another **2. marianarum**
Larger, more than 3 mm. long, antennal segment II clearly longer than either III or IV 2
2. Interocular distance just behind inner subbasal notch of each eye greater than length of either antennal segment III or IV; pubescence very short and grayish brown on pronotum and scutellum, slightly longer and yellowish brown on hemelytra, hemelytral markings as in figure 5..... **4. palauana**
Interocular distance just back of inner subbasal notches of eyes subequal in width to length of either antennal segment III or IV..... 3
3. Pubescent hairs on dorsal surface interspersed with moderately longer hairs; hemelytral markings as in figure 4..... **3. guamensis**
Pubescent hairs shorter, without longer hairs, grayish brown on pronotum and scutellum, yellowish brown with patches of golden on hemelytra..... **5. boninana**

2. *Saldula marianarum* Usinger (fig. 3).

Saldula marianarum Usinger, 1946, B. P. Bishop Mus., Bull. 189:100.

Small ovate. Head, pronotum, and scutellum black, shiny, with clypeus, ocelli, and calose spots between ocelli and eyes ochraceous; hemelytra rather dull, pale testaceous tinged with brownish, with pale spots as in figure 3; membrane with four long, clear cells. Pubescence short, mostly grayish brown on pronotum and scutellum, dark brownish on hemelytra with some golden on clavi. Legs pale. Antennae with segments I and II whitish testaceous, III and IV blackish fuscous. Body beneath blackish on head and thorax, brownish on abdomen. Length 2.65 mm., width 1.25 mm.

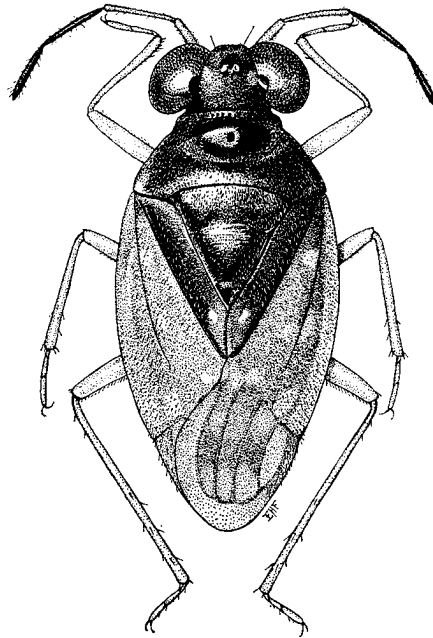


FIGURE 3.—*Saldula marianarum*.

Head across ocelli and eyes 0.92 mm. wide, vertex across ocelli 0.30 mm. wide, the space just behind subbasal notches on inner side of eyes 0.42 mm. wide. Labium brownish fuscous, shiny, extending beyond sternum onto base of abdomen. Antennae 1.50 mm. long, segmental measurements: I, 24; II, 32; III, 32; IV, 32. Pronotum with lateral sides nearly straight, strongly converging anteriorly. Hind wings hyaline, nearly as long as hemelytra. Female and brachypterous form unknown.

DISTRIBUTION: S. Mariana Is. (Guam) and Caroline Is. (Koror).

S. MARIANA IS. GUAM: Agana swamp, male holotype, May 4, 1936, Usinger.

PALAU. KOROR: Male, on wet moss, Sept. 7, 1953, Beardsley.

The small size and the short antennae with the last three segments subequal to one another in length distinguish this species from its Micronesian congeners. The holotype is illustrated.

3. *Saldula guamensis* Drake and Hottes (fig. 4).

Saldula balnearum Usinger (not Bergroth), 1946, B. P. Bishop Mus., Bull. 189: 100.

Saldula guamensis Drake and Hottes, 1950, Biol. Soc. Washington, Proc. 63: 178.

Saldula guamensis, Drake and Hoberlandt, 1951, Mus. Nat. Prague, Acta Ent. 26 (376): 8.

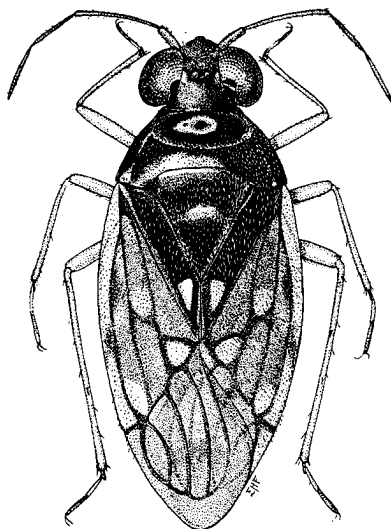


FIGURE 4.—*Saldula guamensis*.

One of the more strikingly marked saldids found in Micronesia is seen in the illustration of the female allotype (fig. 4). Female larger than male and has longer antennal segment II. Length, male 3.20 mm. and female 4.00 mm.; width, male 1.20 mm. and female 1.30 mm.

Dorsal surface of pronotum and hemelytra with yellowish-brown pubescence interspersed with slightly longer hairs of same color. Width of head across ocelli 1.08 mm., vertex at ocelli 0.40 mm. wide, distance across interocular space immediately back of inner subbasal notches of eyes 0.50 mm. Antennal measurements: segment I, 32; II, 45 (male) and 54 (female); III, 41; IV, 42. Length of either antennal segment III or IV and distance across vertex just back of inner subbasal notch of eyes subequal to one another (41: 42).

DISTRIBUTION: S. Mariana Is. (Guam).

S. MARIANA IS. GUAM: Mt. Chachao, male holotype (CAS), female allotype (BISHOP), May 16, 1936, Usinger.

4. *Saldula palauana* Drake, n. sp. (fig. 5).

Head black, shiny, with transverse ridge of fore head, clypeus and *laminae maxillaris* flavotestaceous; ocelli and callose spot between each ocellus and eye flavous. Pronotum and scutellum black, shiny, clothed with short, grayish-brown pubescence. Hemelytra rather dull, clavi and coria mostly blackish with former usually darker, embolium flavotestaceous, membrane brownish with pale streak in some cells, pubescence on clavi and coria slightly longer than that on pronotum, yellowish brown and golden. Body beneath black on thorax, dark fuscous on abdomen, with grayish-white pubescence. Antennae with segment I or I and II testaceous, other segments blackish fuscous. Legs testaceous with upper surface of femora brownish, tips of all tarsal segments fuscous. Length 3.30 mm., width (across apices of clavi) 1.40 mm.

Head with shallow median longitudinal furrow on vertex, 1.00 mm. wide across eyes; vertex across ocelli 0.40 mm. wide; distance across vertex just behind inner

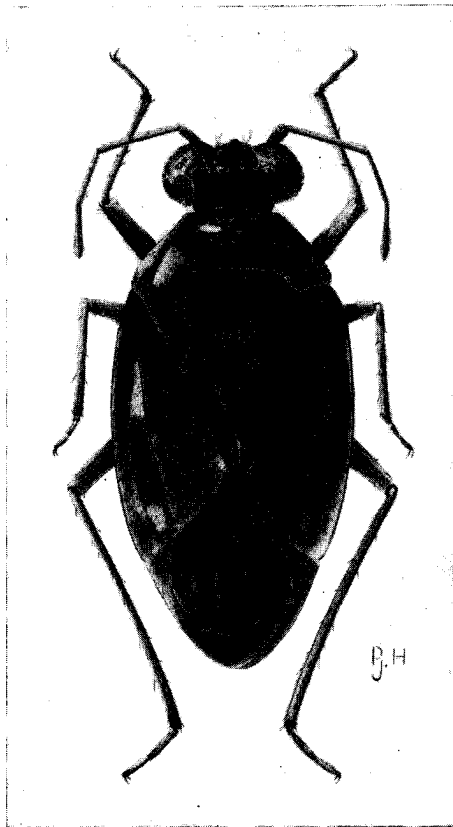
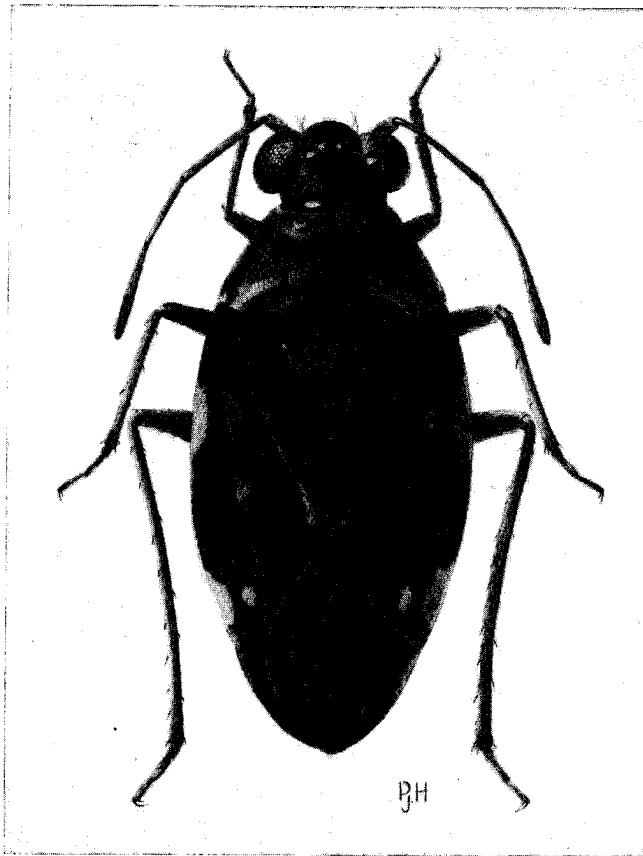


FIGURE 5.—*Saldula palauana*.

FIGURE 6.—*Saldula boninana*.

subapical notches of eyes 0.48 mm. Antennal measurements: I, 26; II, 45 (male) and 50 (female); III, 32; IV, 32. Labium long, extending onto base of abdomen. Last two tarsal segments of both middle and hind legs subequal in length.

Pronotum with lateral sides converging anteriorly in straight line, broadly concavely emarginate behind; callus large, swollen, set off by usual furrows, twice as long as hind lobe of pronotum. Scutellum tumid, transversely sulcate at middle, with distal half finely, transversely rugulose, and slightly elevated at apex. Membrane with four cells. Hind wings long, clear, nearly as long as hemelytra. Brachypterous form unknown.

Holotype, male (US 65456) and allotype, female, Ulimang, Babelthuap, Palau Is., Dec. 21, 1947, Dybas. Paratypes: 11 specimens, same data as for type; one, Malakal, Palau Is., May 2, 1957, Sabrosky.

DISTRIBUTION: Caroline Is. (Palau).

Specific key characters and illustration of the type distinguish this species from other Micronesian *saldulas*.

Pronotum with lateral sides converging anteriorly in nearly a straight line (feebly concave), basal width much greater than median length (110:46); callus large, inflated, with large discal fovea, twice as long as hind lobe of pronotum, the latter broadly concavely emarginate behind. Scutellum with basal width and median length subequal (72:70), transversely sulcate at middle. Hind lobe depressed with apex raised. Membrane with four long, closed cells. Hind wings clear, almost as long as hemelytra. Tarsal segments II and III of both middle and hind legs subequal in length. Female and brachypterous form unknown.

Holotype, male (BISHOP 3012), Nandarivatu (Madarivatu), Viti Levu, Fiji, Sept. 3, 1938, Kondo. Paratypes, all Fiji: North Ovalau, 240-300 m., Apr. 14, 1938, Zimmerman; three, same locality as for type, 720 m., Sept. 14, 1938, Zimmerman.

DISTRIBUTION: Fiji Is.

Two specimens, taken with the paratypes, have differently shaped and colored hemelytral marks and are not being treated as part of the type series.

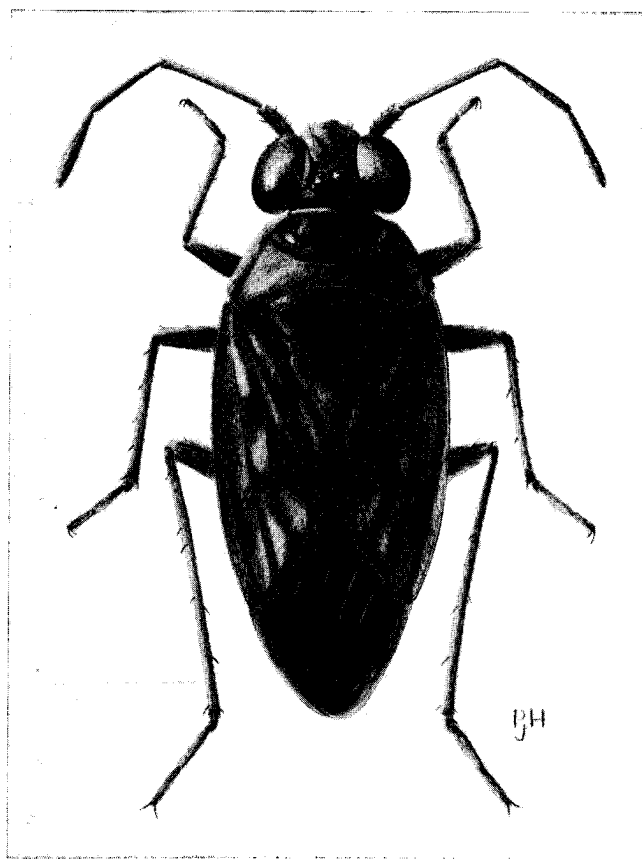


FIGURE 9.—*Pentacora sororia*.

This species is clearly separated from the Micronesian and other species of *Saldula* from Oceania by the antennal measurements and pale humeral marks. Antennal segment III or IV is distinctly longer than the distance between the subapical inner emarginations of the eyes.

Genus *Pentacora* Reuter

Pentacora Reuter, 1912, Öfv. Finska Vet.-Soc., Förh. 54 (A) : 7, 10.

Pentacora, Drake and Hoberlandt, 1951, Mus. Nat. Prague, Acta. Ent. 26 (376) : 5.

Type species: *Salda signoreti* Guérin.

This genus is well represented on the islands of the south Pacific and Indian Oceans, also in India and Australia. It was originally described from the Americas.

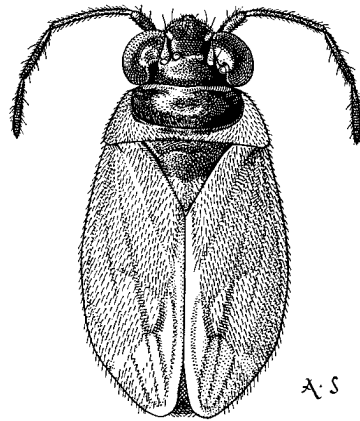


FIGURE 10.—*Orthophrys pygmaeum*.

The species found in the Old World are: *Pentacora sororia* Drake (fig. 9) from the Solomon Islands, *P. sonneveldi* Bloete from the Celebes, *P. malayensis* (Dover; new combination, transferred from *Salda*) from Malaya, *P. salina* (Bergroth) from the Australian Region, and *P. iberica* from Spain and the Mediterranean Region. All of these species are primarily halophilous. The brachypterous form is unknown.

Genus *Orthophrys* Horváth

Orthophrys Horváth, 1911, Mus. Nat. Hungarici, Ann. 9 : 335.

Orthophrys, Reuter, 1912, Öfv. Finska Vet.-Soc., Förh. 54 (A) : 6, 10.

Orthophrys, Drake, 1958, Univ. Lisbon, Fac. Cien. Rev. 2 (6) : 145.

Type species: *Acanthia* (*Chiloxanthia*) *pygmaea* Reuter.

This genus is represented by two species, *Orthophrys pygmaeum* (Reuter) from the Mediterranean Region and *O. mexicanum* Van Duzee from an island in the Gulf of Lower California.

In general aspect, the species of *Orthophrys* resemble those of the genus *Pentacora* but are readily distinguished by the structural characters mentioned



FIGURE 11.—*Omania marksae*.

in the generic key. *Orthophrys pygmaeum* of the Old World is illustrated (fig. 10). The species are all halophilous and inhabit intertidal rocks of sea-shores. The macropterous form is unknown.

Genus *Omania* Horváth

Omania Horváth, 1915, Mus. Nat. Hungarici, Ann. 13: 598.

Omania, Woodward, 1958, Univ. Queensland Papers, Dept. Zool. 7: 100, three figs.

Type species: *Omania coleoptrata* Horváth.

The members of the genus *Omania* are by far the smallest of the shore-bugs. Three species have been described, all of them brachypterous and thus flightless. The species are ovate, beetlelike in appearance, about 1.60 mm. long, halophilous, and inhabitants of coral reefs and intertidal rocks of the seacoast of tropical and subtropical regions. Woodward (1958, op. cit., 100-110) augmented the original description of his *O. marksae* with excellent illustrations of both nymphs and adults. A good account is also included of the ecology and feeding habits of *marksae*, which were observed at low tide on the intertidal coral rocks of the Great Barrier Reef (Low Isle and Heron Isle) off the coast of Queensland.

The type species, *O. coleoptrata* Horváth, inhabits similar sorts of abodes in the interstices of intertidal rocks of the seacoast of the Holomediterranean region, and its ecology and movements on the intertidal rocks are similarly related to the periodical rise and fall of the tidal waters in its environment.

The third member of the genus, *O. samoansis* Kellen (1960, Ent. Soc. Am., Ann. 53: 494-499, 15 figs., one table) from Samoa was collected in numbers by repeated searches at low tide of the volcanic rocks lying within the habitual band in the tidal zone of a sheltered lagoon along the seashore. According to Kellen, the tide in this lagoon is about 3 feet and about 25 feet of the beach is exposed at low tide. As the saldids inhabit only a narrow middle band of the tidal zone, both nymphs and adults are buried in their secluded retreats in the interstices of the rocks under as much as 3 feet of salt water at high tide. The original description includes fine illustrations of various stages of the life cycle of *samoansis*.

In several respects, the ecology and habits of all three species of *Omania* are very similar to one another. Both adults and immature stages move about on the surface of wet rocks during low tide searching for prey. With the incoming of high tide, they seek their haunts in the interstices of the rocks and remain secluded therein under the salt water until the tide again recedes. Thus, collecting must be done with the flow and ebb of the tides.

Besides the structures mentioned in the generic key, the head is not prolonged anteriorly in front of the eyes, nearly vertically deflexed in front, and there is a slightly raised, distinct collum on the posterior part of the vertex. The shape of the collum provides distinctive characters. The absence of explanate lateral margins of the pronotum is another singular generic character.

Since the macropterous form is unknown, it is impossible to determine the number of cells in the fully developed hemelytron membrane. The membrane of the metathoracic wing is reduced or completely absent in brachyptery.

The discontinuous distribution of the species of *Omania* shows the lack of insect faunal studies of intertidal rocks and coral reefs in the tropical and subtropical regions of all oceans. A paratype of *O. marksae* is illustrated (fig. 11).

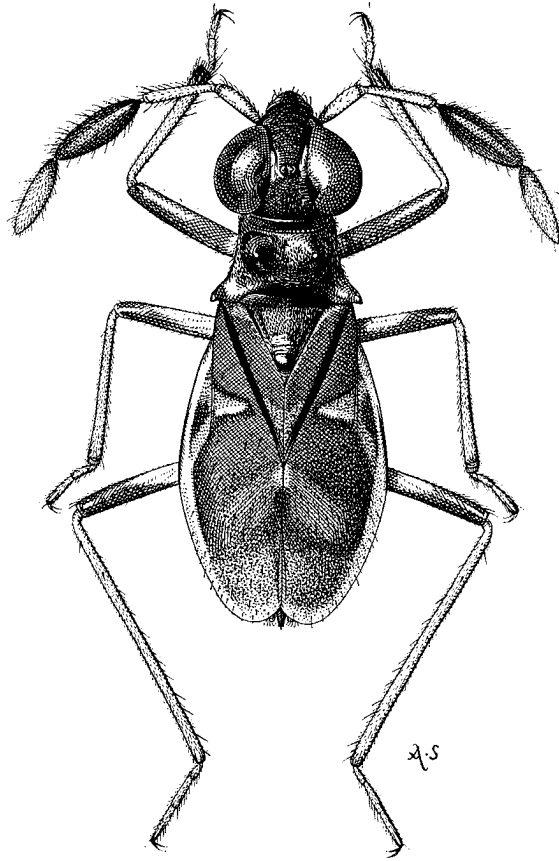


FIGURE 12.—*Saldoida armata*.

Genus **Saldoida** Osborn

Saldoida Osborn, 1901, Canadian Ent. 33: 181.

Saldoida, Reuter, 1912, Öfv. Finska Vet.-Soc., Förh. 54 (A): 23.

Saldoida, Drake and Chapman, 1958, Ent. Soc. Am., Ann. 51: 480-485, five figs.

Type species: *Saldoida slossoni* Osborn.

Only one species, *Saldoida armata* Horváth (fig. 12) is known to occur in the Oriental Region. *S. bakeri* Poppius of the Philippine Islands is a synonym of *armata*. Brachypterous and macropterous specimens have been examined from Taiwan, Philippine Islands (Luzon), and India (Dehra Dun and Cantomen). The enormous, pyramidlike, upright structures (fig. 13) of the

anterior pronotal lobe and the slightly swollen and pale markings on the last two antennal segments set this species apart from all other saldids of Oceania.

The members of *Saldoida* are very difficult to find as well as hard to catch. They inhabit low, permanently wet areas adjacent to the shores of bogs, swamps, lakes, and streams. *S. armata* is represented only in few collections, although it is widely dispersed in the Oriental Region.

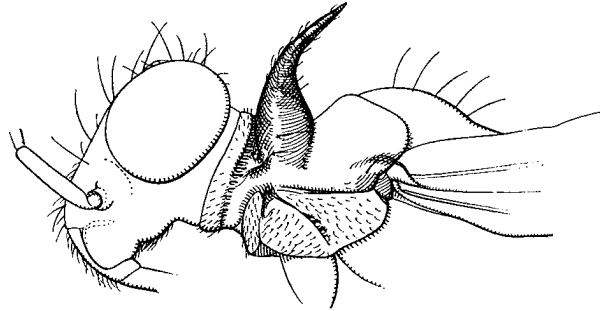


FIGURE 13.—*Saldoida armata*, lateral view.

